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The Philippine Agriculturist

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MESSAGE

On this, our Golden Jubilee Year, we would like to partake of the feelings of a rice farmer who, after hours of stooping over at transplanting, stretches his back and gazes around. The job of selecting and bringing up our student material into effective scientific farmers is not always pleasant. The unfit will have to be weeded out; the less malleable worked on longer. The best of intentions could be misunderstood. On the other hand, the task of wresting from Nature the facts to be passed on to the students is not without disappointment. The best planned experiment may produce quite unexpected results. These continuous efforts at probing into the unknown and disseminating the known—at times with rather disheartening results—are not infrequently quite taxing.

At the same time, we feel fully rewarded when finally we count the blessings: our some 3,000 alumni who are now distributed throughout the country and are extending by words and deeds the gospel of scientific agriculture; the numerous promising varieties of plants and breeds of animals which the College turns out for distribution to farmers; new ways of efficient farming; our some 2,000 published scientific contributions.

We believe that through its accumulated results in the last fifty years, the College of Agriculture, University of the Philippines, is justified in feeling proud of its efforts and in looking into the future with determination.

L. B. UICHANCO
Dean
College of Agriculture

THOMAS LENOIR YORK

WHEREAS, In the early and untimely death of Thomas Lenoir York the agricultural profession lost a dedicated scientist, conscientious worker and inspiring teacher; and

WHEREAS, He made valuable contributions to agriculture, especially in breeding for disease resistance in vegetables, which benefited and which were greatly appreciated by farmers in the Philippines and elsewhere; and

WHEREAS, During his tenure as visiting professor in the College of Agriculture, Doctor York showed the qualities of an ideal scholar and true friend, willing and eager to contribute to Philippine agriculture and to guide future agriculturists; now therefore be it

RESOLVED, that the faculty of the College of Agriculture of the University of the Philippines, hereby express its feeling of grievous loss and extend to his widow and children its expression of deep sympathy; and be it further

RESOLVED, that copies of this resolution be spread in the minutes of the faculty of the College of Agriculture and sent to the archives of the University, and that they be published in *The Philippine Agriculturist.*

(Sgd.) V. C. CALMA

(Sgd.) E. CU-LEGASPI

(Sgd.) L. H. MACDANIELS

(Sgd.) J. R. VELASCO

(Committee)

(Resolution passed by the faculty of the College of Agriculture on March 24, 1958).

SOME APPLICATIONS OF AERIAL PHOTOGRAMMETRY IN AGRICULTURE [1]

BENEDICTO SELIRIO

WITH ONE TEXT FIGURE

Surveying in a broad sense is the art of making measurements on the surface of the earth. We have been using the conventional ground method, but science has brought us another which is relatively cheaper, faster, and more comprehensive. It is called aerial photogrammetry.

This new method of surveying makes use of quantitative and qualitative measurements from aerial photography. The photographs are exposed from an air-borne craft, in such a way that exposures overlap each other in imprinting the image of the terrain. These photographs provide excellent data for the users of photogrammetry, among the many of which is the field of agriculture.

The theory of photogrammetry was first explored early in the fifteenth century. Foremost among the early authorities was Aime Laussedat of France. His works were so extensive that he was named the "Father of Photogrammetry." Early experiments were made by using kites and balloons, but with the invention of the airplane aerial photogrammetry was on its way to recognition.

Europe was the first region to recognize the usefulness of photogrammetry. It had already successfully used photogrammetry in land surveying when the United States began experimenting with aerial photographs. The first large-scale use of aerial photogrammetry was launched by the U. S. Department of Agriculture for studying land use, forest products, soil conservation, and drainage problems. Other U. S. governmental organizations are now using aerial photogrammetry for general mapping, exploration of natural resources, water control, water development, soil classification, and engineering surveys.

In the field of agriculture aerial photogrammetry can be used for (1) studying the physical properties of the terrain, such as type of soil, drainage, land form, vegetation, etc.; (2) identifying kinds

[1] General Contribution No. 884.

of vegetation and estimating crop yields; (3) classifying land with regard to use and soil management practices for land conservation and development; and (4) relating engineering aspects in agriculture to such projects as irrigation, water control, feeder roads, etc.

When looking at an aerial photograph the observer feels that he is way up above the ground, and he sees the bird's-eye view of the terrain. Buildings, rivers, trees, and roads look familiar to him, and he uses these recognizable features to expand his familiarity and extract more information. His best aids are his eyes and brain. Training and experience are important factors, too. Good photographic prints give more information because of the sharpness of shade and color.

The use of the stereoscope enables the observer to see a tridimensional view of the photographed terrain. Two overlapping photographs are viewed simultaneously by each eye, and the two photographs are fused together into a single view. Rays of light from identical objects on each photograph as received by the eyes seem to intersect in space. This phenomenon is called the "stereoscopic effect" and the resulting view is a miniature scale model of the actual terrain. Qualitative measurements are then made easy.

Standard identification procedures have been established, but they do not always apply to all countries. In photo-interpretation, conclusions tend to be general before specific items could be established. A familiar object catches the eye immediately, and the proper procedure is to make the known object a bridge to the unknown items. A working brain always finds reason for the presence of a building, a river, or a road. A single item reveals countless other details which are in some way or another related to the entire picture.

An aerial photograph is a miniature representation of an area, and only a known familiar object can reveal the size to which the print has been reduced. Comprehending the size and the shape of an unknown image helps in identifying it. The color tone quality of the photograph identifies objects from blending into each other. Dark colors appear as black and light ones which reflect light appear as white.

Cultivated land appears as an irregular patchwork of color tones. Each farm is separated by distinguishable boundaries composed of fence lines, streams, or just cleared lines used for transpor-

tation. This very familiar appearance of agricultural activity is the product of inherent human characteristics and of the natural differences of environment. Patches of different color tones are the results of the type and time of cultivation, kind and age of crop, type and condition of the soil, and other physical phenomena that alter the appearance of the terrain.

Identification of crops depend upon the locality, climate, topography, season, and familiarity of their appearance at particular growing stages. The presence of irrigation ditches and paddies may identify the crop at a specified season. Orchards appear as regularly spaced dots, while forests are canopies of thick foliage. Identifying the specific tree may require knowledge of the appearance of different kinds of orchard trees. Identification of out-of-season crops is practically limited to large-scale photographs. Pastures usually show the presence of fences and animals. The productivity of the land may be approximated from the study of topography, vegetation, and drainage characteristics. Crop yield can then be deduced accordingly.

Knowing the types of vegetation is the key to soil classification. Rocks do not usually support any vegetation, while granular soils may have a few sparse growths. Natural growths of green cover is the product of the suitability of the plant to such type of soil. More fertile soils are usually cultivated and different types will show different color tones. Another aid in soil classification is the study of drainage patterns. Soils with excellent internal drainage do not show the presence of deep continuous gullies. Varying degrees of erosion indicate different types of soils. Further information can be achieved by studying the land formations.

There are however, cultural changes which may mislead the interpreter. In a farmstead, farm buildings scatter all over. Barns are large yet simple in layout. Residences are closer to the road, and are of medium size. Sheds are small structures in far-off corners of the farm. Garages show the unmistakable driveway. The practice of soil conservation alters the appearance of the farm. Terraces are not always for lowland rice; groups of trees are not always orchards; strips of grassland are usually mistaken for crops. All other human factors considered, there is no substitute for skill and experience in the interpretation of aerial photographs.

So far only qualitative measurements were discussed. Quantitative measurements are made for types of work that use horizontal and vertical distances, such as location and design surveys, earthwork calculations, water development, and other projects. Other uses of aerial photogrammetry are found in military activities, cadastral surveys, mining development, exploration of natural resources, etc.

In many countries the use of aerial photogrammetry is a standard practice. It has now advanced in technique and instrumentation that the new method is adopted in all large-scale surveying work. The fact that many copies of photographs can be printed from a single flying operation makes its use extensive, and the same photograph can be used over and over again for different purposes. Compared with the conventional ground survey method, aerial photogrammetry is 40 per cent cheaper and 50 per cent faster. Because of first cost considerations the percentage figures are good only for surveys of areas of more than 50 hectares.

Aerial photogrammetry is more comprehensive than the conventional survey because it records every detail visible on the subsurface of the earth. Natural formations reveal the sub-surface conditions not visible to the eye. Curves and lines are shown in their true shape and orientation. All of these advantages make aerial photogrammetry an accurate and reliable tool.

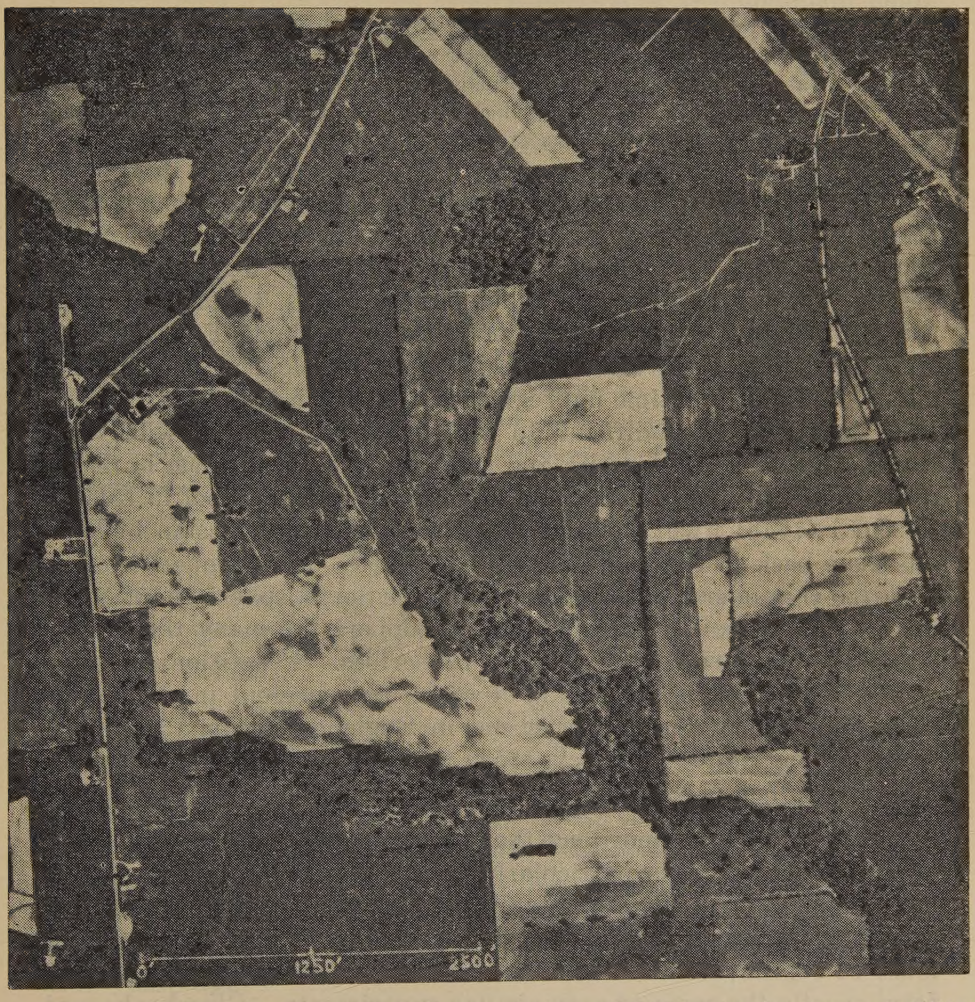

Fig. 1.—An aerial photograph. Note patches of different color tones resulting from the type and time of cultivation, kind and age of crops, type and condition of soil, and other vegetative cover. Also note cultural and natural features. Scale of the photograph is 1:10,000.

MULTIPLE FERTILIZATION IN MAIZE (*Zea mays* L.)[1]

H. L. Everett, D. L. Umali, and I. S. Santos

Data obtained from crosses utilizing the Yellow vs. White and Non-waxy vs. waxy loci failed to indicate the occurrence of multiple impregnation and fertilization in maize.

A recent report by Gluschenko *et al.* (1956)[2] states that by pollinating a female parent which carries the recessive forms for the characters, with a mixture of pollen grains from two male parents each of them carrying one of the dominant forms, a combination of the two dominant characters is obtained in a single F_1 individual. Gluschenko explained this on the basis of a biological phenomenon which he termed multiple impregnation. As a hereditary force, multiple impregnation is difficult to explain on the basis of widely accepted knowledge in genetics and cytology. Its occurrence is recognized by the presently prevailing Michurin-Lysenko school in Russia. Lysenko (1948),[3] while eliminating fortuities from Russian biology, has gone back to the long discredited theories on the inheritance of acquired characters. Biologists outside the Soviet sphere of influence have found no convincing evidence to support the many theories to which the Michurin-Lysenko school subscribes. Repetitions of some of their experiments the results of which they present in support of these theories have been carried out in England (Sachs, 1951)[4] and in the United States (Burdick, 1952),[5] and no confirmation of Lysenkian claims has been obtained.

It is of utmost importance that new biological facts or principles be appraised. This is particularly true where the new principle is not in consonance with well-established concepts. If a new principle is to be established firmly, the results of experiments supporting it must be reproducible when other workers (in other countries) perform exactly the same or very similar experiments. Gluschenko and

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[1] Central Experiment Station Contribution No. 1972.

[2] I. E. Gluschenko, "Multiple impregnation of plants." Paper read during the International Genetics Symposia held at Tokyo and Kyoto, Japan from September 6 to 12, 1956. (I. E. Gluschenko is professor at the Institute of Genetics Academy of Science, Moscow.)

[3] T. Lysenko, "The science of biology today," New York, N.Y., International Publishers Co., Inc., p. 49 (1948).

[4] L. Sachs, *Nature*, **167**: 282-283 (1951).

[5] A. B. Burdick, *Records Genet. Soc. Am. Abstract*, p. 14 (1952).

his co-workers concluded that multiple fertilization occurs widely and with a relatively high frequency. They reported the occurrence of multiple impregnation in corn, tomato, wheat, and four o'clock (*Mirabilis jalapa*). Frequencies of combination of two dominant characters contributed by two different male parents in an F_1 individual ranged from 0.45 per cent in wheat to 59.2 per cent in a group of F_1 tomato plants.[6]

The average for 19 families involving the four plant species mentioned was 19.26 per cent. In corn, specifically, four progenies indicated an occurrence of 2.5, 1.5, 24.7, and 7.7 per cent, respectively.

Gluschenko's experimental results have aroused considerable interest on the subject of multiple impregnation. Many geneticists and cytologists are skeptical about the results. The verification of Gluschenko's conclusions is deemed important to the biological world. This experiment to test the concept of multiple impregnation was planned and carried out in the Division of Plant Breeding, U.P. College of Agriculture from December, 1956 to March, 1957.

MATERIALS AND METHODS

Pure breeding stocks of white waxy corn, yellow waxy corn, and white flint corn were used in this experiment.

Stock	*Kernel Phenotype*	*Plant Genotype*
A205	White flint	yyWxWx
College Yellow Glutinous	Yellow waxy	YYwxwx
Mt. Prov. White Glutinous	White waxy	yywxwx

A205 is an inbred line extracted from the College White Flint variety; College Yellow Glutinous was obtained from College Yellow Flint through a mutation to yellow waxy kernels about two years ago; and Mt. Province White Glutinous was obtained from one of the white flint collection which segregated for the waxy character, about three years ago.

These materials were grown in a field at Faculty Hill, U.P. College of Agriculture during the dry season of 1956-57 (December, 1956 to March, 1957). In all the crosses, the Mt. Province White Glutinous was utilized as the female parent by virtue of its being a double recessive for the waxy vs. non-waxy endosperm character and

[6] Information obtained from Dr. J. M. Capinpin, Philippine delegate to the International Genetics Symposia, 1956.

for the Yellow vs. white endosperm character. Emerson, Beadle, and Fraser (1935)[7] described white endosperm as a simple recessive to yellow endosperm, and waxy endosperm as a simple recessive to non-waxy endosperm.

The following pollen or pollen mixtures were used to pollinate ears of Mt. Province White Glutinous.

(1) *yWx* pollen from A205
(2) *Ywx* pollen from College Yellow Glutinous
(3) A 50-50 mixture by volume of *yWx* and *Ywx* pollen. In addition, double pollinations at 6-, 12-, and 18-hour intervals were performed. For each time interval, one pollen type was placed ahead of the other on some ears, and *vice-versa* on the other ears.
(4) *ywx* pollen from tassels of Mt. Province White Glutinous (selfing).

If multiple impregnation occurred, a relatively large number of yellow flinty kernels should be observed on ears pollinated with the pollen mixture. Such grains should have the following endosperm genotype: *yYwxWx* (Yellow, Flinty or Non-waxy). It is recognized that the endosperm is triploid in chromosome make-up but the genotypes are presented for simplicity as diploid since the two female complements contained in the fusion nucleus are usually identical.

If no multiple impregnation occurs, the ears pollinated with the pollen mixtures should have kernels indicating only the following endosperm genotypes:

(1) yywxWx (White, Flinty or Non-waxy).
(2) yYwxwx (Yellow, waxy).

Xenia operates to indicate the immediate effect of the dominant genes of the male parent on the endosperm characteristics of the F_1 seed. These hereditary characteristics in kernel type are easily distinguished on the ear through direct visual observation. Moreover, waxy endosperm can be differentiated from non-waxy endosperm with absolute certainty through the use of the iodine stain test as described by Santos, Everett, and Aquilizan (1957).[8] Visually, white waxy is ivory white in color while white flint is transparent white;

[7] R. A. Emerson, A. W. Beadle, and A. C. Fraser, *Cornell Univ. Agr. Expt. Sta. Memoir* **180** (1935).
[8] I. S. Santos, H. L. Everett, and F. A. Aquilizan, *Philippine Agriculturist*, **40**, 538-543 (1957).

yellow waxy is "ivory" or opaque yellow while yellow flint is transparent or shiny yellow.

EXPERIMENTAL RESULTS

The selfings of the three stocks used in this experiment indicated that these were pure for the characters involved, as previously described. All 507 selfed kernels of Mt. Province White Glutinous were white and waxy.

The cross between Mt. Province White Glutinous and A205 resulted in white, flinty kernels. A total of 1566 kernels were observed. The 456 kernels resulting from the cross between Mt. Province White Glutinous and College Yellow Glutinous showed only yellow and waxy phenotypes. These results confirm the dominance of yellow color and of non-waxy endosperm.

Results from the use of pollen mixtures are summarized in table 1.

TABLE 1.—*Frequency of kernel types resulting from pollination of Mt. Province White Glutinous ears with a mixture of pollen of College Yellow Glutinous and of White Flint inbred A205*

INTERVAL (Hr.)	SEQUENCE OF POLLINATION [a]	KERNEL TYPE [b]				REMARKS
		Yellow Flinty	Yellow Waxy	Flinty White	White Waxy	
0	Mixed	0	522	152	1	[c]
6	W.F. followed by Y.W.	0	261	708	4	
6	Y.W. followed by W.F.	0	678	35	1	[c]
12	W.F. followed by Y.W.	0	27	596	2	
12	Y.W. followed by W.F.	0	805	34	4	
18	W.F. followed by Y.W.	0	14	1160	2	[c]
18	Y.W. followed by W.F.	0	1315	18	2	

[a] W.F. = White Flint College White Flint inbred A 205;
Y.W. = College Yellow Glutinous (Waxy).

[b] Four ears counted for each type of pollination.

[c] Two of the four ears yielded kernels with anthocyanin (purple or red) color in the aleurone layer indicating that the stock are segregating for complementary genes which control formation of aleurone color as described by Emerson *et al.* (1935).

Six thousand three hundred forty-one (6,341) F_1 kernels from 28 corn ears failed to show a single example of a kernel combining the dominant factors from each of the two male parents. That is, none of the kernels was yellow and flinty (non-waxy). The presence

of a few white, waxy kernels can easily be explained on the basis of self-contamination.

An interesting relationship between rate of growth of pollen tube and interval allowed between separate pollinations was indicated by the data in table 1. To show this relationship more clearly, pertinent computations were done and the results are given in table 2.

TABLE 2.—*Ratios between the number of yellow, waxy kernels and of white flint kernels in the different pollinations using pollen from two different male parents*

INTERVAL (Hr.)	MANNER OF COMPUTATION [a]	RATIO	TOTAL NO. OF KERNELS
0 (Mixed)	W.F./Y.W.	0.29	675
0 (Mixed)	Y.W./W.F.	3.43	675
6	W.F./Y.W.	2.71	973
6	Y.W./W.F.	19.37	714
12	W.F./Y.W.	22.07	625
12	Y.W./W.F.	23.68	843
18	W.F./Y.W.	82.86	1176
18	Y.W./W.F.	73.06	1335

[a] The number of phenotype which corresponds to the genotype of pollen placed ahead is used as the numerator, except in the 0 interval (mixed).

When pollen grains from College Yellow Glutinous and A205 are mixed equally by volume and applied to the silks of Mt. Province White Glutinous, the "yellow, waxy" pollen from College Yellow Glutinous fertilized an average of 3.43 kernels for every kernel fertilized by the "white, non-waxy" pollen from A205. This superiority is still evident in the pollination allowing a six-hour interval between applications of the two types of pollen. When the "yellow, waxy" pollen was placed six hours ahead the ratio was 19.37:1 while when the "white, non-waxy" pollen was placed six hours ahead the ratio while reversed was only 2.71:1. This indicated that even with a six-hour advantage certain "inbred" pollen could still be overtaken by the "variety" pollen. With an interval, however, of 12 hours or more, the relative vigor of the pollen did not have any effect on the ratios.

Two explanations for the superior pollen tube growth of the College Yellow Glutinous over that of the inbred A205 may be offered. One is that the growth of a "waxy" pollen grain on silks of a waxy variety may be favored over that of a "flinty" pollen on

"waxy" silks. Another, which perhaps is the more plausible, is that the "variety" pollen has greater heterozygosity and hence, greater vigor than the "inbred" pollen.

DISCUSSION AND CONCLUSION

Data obtained in this experiment failed to support the occurrence of multiple impregnation in maize as claimed by Gluschenko *et al.* (1956). Failure to find any supporting evidence on the claims of Gluschenko and his co-workers makes desirable some sort of reconciliation between the results of their researches and those obtained in this experiment. Several proposals may account for the non-agreement of the results:

(1) Gluschenko's plant materials were uniquely characterized by a genetic potential for the manifestations of multiple impregnation;
(2) Gluschenko's plant materials were uniquely characterized by mutable genes;
(3) Gluschenko's plant materials were heterozygous for complementary genes which simulated the F_1 combinations of dominant factors from the two sources of pollen;
(4) Gluschenko's plant materials included mixed or misclassified stocks.

The first two proposals do not seem warranted and, hence, proposals (3) and (4) seem more plausible in explaining how Gluschenko and his co-workers obtained the results that they reported. Hence, it appears that Gluschenko and his co-workers have actually not presented any valid data to challenge the presently and widely accepted biological fact that only one male gamete actually succeeds in uniting with the egg nucleus and another male gamete (usually from the same pollen grain) unites with the fusion nucleus.

THE RESPONSE OF FORTY-SIX RICE VARIETIES TO PHOTOPERIOD [1]

J. R. Velasco and R. K. dela Fuente [2]

In the Philippines, rice varieties are generally classified into two categories with regard to fruiting: (1) period-bound varieties which come to flower after a number of days of growth, and (2) season-bound varieties which flower only in certain seasons of the year, usually from November to January. The first group roughly corresponds to the day-neutral plants in photoperiodic literature. Most early maturing varieties are considered period-bound or day-neutral. In areas where water is available the year round, these varieties are grown throughout the year. The second group is composed of short-day varieties, so-called because they flower when the days are shortest. In recent studies (Velasco and Manuel, 1955; Manuel and Velasco, 1957), Elon-elon, a representative of this group, was actually proved to be a short-day plant. Most late maturing varieties (170-195 days) are considered season-bound. They are planted only in June and July.

Dela Fuente and Velasco (1955) observed that the age of flowering of Thailand variety, which is considered period-bound varies considerably when planted at different times of the year. In order to re-examine the foregoing general conception on the response of varieties to photoperiod, these pertinent experiments were conducted.

Five plantings were made from March, 1957 to May, 1958, but data were taken from only four plantings because the August 23, 1957 planting was severely attacked by stem borers.

MATERIALS AND METHODS

With very slight variations, the following was the procedure adopted in the different plantings: the seeds were germinated be-

[1] Central Experiment Station Contribution No. 1973. Part of Project No. 952. The early part of this work was financed by a grant from the NARIC; the latter part by funds from Republic Act 1606.

[2] The authors acknowledge the assistance of Messrs. Jose D. Ona and Gavino Ilagan in conducting this work.

tween two sheets of blotting paper, drenched with water and placed in a germinator at a temperature of about 30°C. Four to five days later, or when the radicle and plumule had already come out, the seedlings were planted in medium-sized pots containing about two kilos of soil. When the seedlings were about 10 cm. tall, they were thinned to only three to a pot. The remaining seedlings were equidistant to each other in the pots. At about 10 to 20 days of age the plants were fertilized with ammonium sulfate at the rate of 2 grams per pot. When the plants were thirty days old, they were subjected to different photoperiods. Six plants of each variety were given 10-hour days by transferring them to the dark room at 4:00 p.m. and putting them out at 6:00 a.m. Six other plants were left in the yard to receive the normal daylight period which is approximately 12 hours. Another six plants were transferred to light chambers at 4:00 p.m. and given supplementary light from 20-watt fluorescent lamps emitting light of about 50 foot candles at 10 cm. below the bulbs. The lights were put off by an interval timer at 9:00 p.m. making a total of 15 hours for this treatment. The date of flower emergence of the first tiller in a hill was considered the flowering date of that hill.

The treatments were generally stopped after subjecting them for two months to the different photoperiods. Those which had not flowered by then were dissected to determine whether the plant was still vegetative or if it had already initiated its floral primordium.

RESULTS AND DISCUSSION

With very few exceptions, the results presented in table 1 are averages of six observations. Of the varieties studied three were conspicuous in that their coming to flower was delayed by treatment with 10-hour days. These were varieties Solo from Indonesia, Taihoku No. 111 and Shinchiku mochi iku no. 43, both from Taiwan. Solo was similarly delayed by the 15-hour day but to a slightly less extent. The latter two were also delayed by long day and to much greater extent than the delay caused by short days. It would seem that these varieties have a narrow optimum light period at 12 hours. Velasco and Manuel (1955) noted that with the progressive decrease in day length from 12 to 6 hours, the Elon-elon variety flowered earlier and reached a maximum flowering age at the 9-hour day. As the day was further shortened, flowering was again progressively delayed.

In this paper a variety is considered day-neutral if its ages at flowering in the various treatments fall within a span of ten days. The following varieties fall under this category: Fortuna negro from Peru, Zenith × Nira (S415 A16-5-1-3) from the United States, P.I. 7217 from Java (Indonesia), Rikuto sanin no. 25 and Taishomochi both from Japan. Although the information is still meagre, the impression that the data leave in the mind is that day-neutral varieties may occur with almost equal likelihood in both the tropics and the temperate zone.

Our unpublished information tends to indicate that the period from flower induction to flower emergence is from 25 to 30 days. This may be used as a yardstick in determining the strength of a variety's response to photoperiod. For our purpose we will consider a variety as weakly photoperiodic if the difference in the ages at flowering between the short-day and the long-day treatments is less than 30 days and strongly photoperiodic if the difference is more than 30 days. The following is a tabulation of the varieties under these two groups:

Weakly photoperiodic:

1. P.I. 160650
2. Norin mochino. 5 L44
3. Tainan-iku no. 490
4. Sinto norim no. 29
5. Arborio tipo
6. Imperial blue rose sel.
7. Hill med. × Zenith Bnt. 54
8. Shinchiku mochi iku no. 43
9. P.R. 388
10. P.I. 8920 a
11. Sinoltero
12. R.B.
13. Blue rose
14. $(E.P.B.R.)^2$ × 7.9054 rogue
15. Prelude

Strongly photoperiodic:

1. In-oban
2. P.T. selection (B52-3557)
3. Taihoku iku no. 111
4. P.I. 160902
5. Thailand
6. B.A.M.
7. Mitao
8. Fi Ho Ju
9. Rizzoto Tipo
10. Zenith
11. Bolibol
12. Shinchiku-iku no. 161
13. Pin chuan B
14. P.R. 358
15. Macan 1
16. Co. 4 × ADT 10
17. Malagkit senador
18. C.I. 7266 Rec. B
19. Chiang An Chih Kei Chieh Lan

20. Remedja
21. BR × BR-R (6-1-21-12)
22. Rexoro sel. (B49-5849)
23. Kinastila
24. Intan
25. Bengawan

These varieties were further classified into those which mature in less than 110 days as *very early,* those which mature in 111-130 days as *early,* those which mature in 131-150 days as *medium late* and those which mature later than 150 days as *late varieties.* The percentages of strongly photoperiodic varieties in these groups are 42.8, 64.3, 88.9, and 87.5, respectively (table 2). The trend seems to be for an increasing proportion of strongly photoperiodic varieties with lateness. Okada and Kato (1953) concluded that late varieties were affected most strongly by short photoperiods, hastening their maturity.

The varieties were also grouped according to their regions of origin. All countries lying 0 to 20° latitude were considered tropical and those lying 21° and above were considered subtemperate and temperate. Comprising the first group are Indonesia, Peru, the Philippines, Puerto Rico, and Thailand. In the second group are China, Italy, Japan, Korea, Spain, Taiwan, and the United States. Because India saddles in both regions, it was disregarded in this classification. Of the fifteen varieties from the tropics 80 per cent were strongly photoperiodic (table 3). Sub-temperate varieties had equal representations of strong and weak responders to photoperiod. Oka (1952) concluded that the degree of sensitivity to photoperiod and the critical day length are closely related to latitude.

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TABLE 1.—*Days to flowering of rice varieties subjected to various photoperiods*

NAME OR DESIGNATION	COUNTRY OF ORIGIN	MATURITY IN THE FIELD [a]	DAYS FROM SOAKING TO FLOWERING		
			Control	10 hr.	15 hr.
First planting [b]					
Solo	Indonesia	159	134	150	146
In-oban	Philippines	168	Veg.	56	Veg.
Macan I	Philippines	142	F.p.	61	F.p.
Pin Chuan B	China	167	F.p.	90	F.p.
P.I. 160650	China	179	72	62	81
P.I. 160902	China	103	74	55	84
T.P. selection (B52-3557)	United States	134	F.p.	70	F.p.
Fortuna negro	Peru	133	F.p.	F.p.	F.p.
P.R. 358	Puerto Rico	138	82	68	F.p.
Taihoku iku no. 111	Taiwan	111	76	86	F.p.
Second planting [c]					
Co 4 × ADT 10	India	126	60	60	F.p.
Thailand	Thailand	135	88	64	93
Malagkit senador	Philippines	154	F.p.	64	Veg.
Mitao	Philippines	167	Veg.	71	Veg.
Sinoltero	Philippines	112	Died	85	112
P.R. 388	Puerto Rico	121	79	69	87
Norin mochi no. 5 L44	Japan	124	81	69	92
P.I. 8920 a	Siam	117	86	71	86
B.A.M.	Peru	136	Died	69	Veg.
C.I. 7266 Rec. B	Taiwan	135	84	73	102
Tainan-iku No. 490	Taiwan	134	75	78	102
Kei Cheih Lan	China	121	Veg.	75	Veg.
Fi Ho Ju	China	116	Veg.	74	Veg.
P.I. 7217	Indonesia	124	104	97	107
Remedja	Indonesia	136	111	78	F.p.
Fourth planting [d]					
Sinto norin no. 29	Japan	91	59.2	53.3	74.0
Rikuto sanin no. 25	Japan	84	60.7	60.7	70.2
Taishomochi	Japan	91	70.3	67.0	73.8
R.B.	Italy	82	57.3	57.8	84.1

[a] Field planting, June 22, 1956. Data were supplied by the Division of Plant Breeding.

[b] Planted, March 26, 1957; photoperiodic treatment, April 23, 1957; treatment stopped June 29, 1957 (95 days old) and plants examined for flower primordia (f.p.).

[c] Planted, May 21, 1957; photoperiodic treatment, June 24, 1957; treatment stopped September 14, 1957 (116 days old).

[d] Planted, October 28, 1957; photoperiodic treatment, November 25, 1957; treatment stopped January 27, 1958 (95 days old).

TABLE 1 (Continued)

Arborio Tipo	Italy	85	60.3	60.2	75.8
Rizzoto Tipo	Italy	87	65.7	66.7	97.2
Blue Rose	United States	91	57.3	57.2	80.0
Imperial blue rose selection	United States	95	57.2	57.5	79.7
BR × BR-R (6-1-25-12)	United States	95	65.0	65.8	Veg.
(E.P.B.R.[2] × 7.9054 Rogue	United States	100	70.2	65.8	86.3
Zenith	United States	100	72.8	69.0	98.2
Prelude	United States	98	70.5	70.2	Advanced F.p.
Hill med. × Zenith Bnt. 54	United States	91	72.7	72.0	98.3
Fifth planting [e]					
Rexoro sel. (549-5849)	United States	127	F.p.	88.0	Veg.
Zenith × Nira (S415 A16-5-1-3)	United States	121	F.p.	F.p.	F.p.
Bolibol	Philippines	115	85	53.6	Veg.
Kinastila	Philippines	164	Veg.	59.1	Veg.
In-oban	Philippines	168	85.1	56.8	Veg.
Solo	Indonesia	159	Veg.	Veg.	Veg.
Shinchiku iku no. 161	Taiwan	115	84.6	87.0	F.p.
Shinchiku mochi iku no. 43	Taiwan	119	77.0	87.0	Advanced F.p.
B.A.M.	Peru	136	Veg.	59.1	Veg.
Intan	Indonesia	160	F.p.	80.5	Veg.
Bengawan	Indonesia	160	F.p.	80.8	Veg.

[e] Planted, February 15, 1958; photoperiodic treatment, March 12, 1958; treatment stopped May 10, 1958 (90 days old).

TABLE 2.—*Maturity of varieties and their reaction to photoperiod*

REACTION TO PHOTOPERIOD	LESS THAN 110 DAYS	111 TO 130	131 TO 150	MORE THAN 150 DAYS
Strong	6	9	8	7
Weak	8	5	1	1
Per cent strong	42.8	64.3	88.9	87.5
Per cent weak	57.2	35.7	11.1	12.5

TABLE 3.—*Region of origin of varieties and reaction to photoperiod*

REACTION TO PHOTOPERIOD	FROM THE EQUATOR TO ABOUT 20° N OR S	FROM ABOUT 21° AND ABOVE N OR S
Strong	12	12
Weak	3	12
Per cent strong	80	50
Per cent weak	20	50

PALAY MARKETING ON THE FARM LEVEL IN NUEVA ECIJA, CAGAYAN AND ILOILO, 1955-1956 [1]

TEODORO B. BAGUILAT [2]

WITH TWO TEXT FIGURES

The survey was an attempt to describe the general situation of palay marketing on farms in three Philippine provinces. Pre-sale practices included drying, threshing, and cleaning. Limited storage was done in houses in Nueva Ecija and Iloilo and in granaries in Cagayan. The market was generally localized and glutted for short periods of rush marketing. Price movements reflected the seasonality of production. The palay farm market was under-developed because of inadequate storing, absence of standard grades and uniform measures, limited market information, and difficulties in transportation.

The significance of rice cannot be overemphasized in a country like the Philippines. As a staple crop, rice supplies 80 to 90 per cent of the calories in the main diet.[3] Rice leads all other crops when we consider the number of farms and the area under cultivation. Of the 1,638,624 farms in the country in 1948, 783,938 or 48 per cent were rice farms.[4] The total cropland was estimated to be 3,711,902 hectares of which 1,648,964 or 44 per cent was planted to rice.

The marketing system, which starts with the farm, deserves as much attention as the production aspects in raising the low income of farmers. An all-out research on the market structure of palay would include farm marketing, wholesaling, warehousing, milling, retailing, and the consumption of rice.

This study was undertaken to (1) appraise the general situation of palay marketing on the farm level, (2) determine the extent of farmers' participation in marketing, (3) identify the marketing

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[2] The writer is grateful to Dr. G. Hedlund, former Cornell visiting professor, Mr. F. Tiongson and the staff of the Department of Agricultural Economics for their helpful suggestions.

[3] John N. Efferson, "The Production and Marketing of Rice," New Orleans, La., Simmons Press, 1952, p. 234.

[4] Philippine Agricultural Statistics, Manila, Bureau of Printing, 1956, p. 13.

problems and the extent to which they are encountered by farmers, (4) determine farm prices and some related factors, and (5) determine variations in markets and marketing practices on the farm.

Nueva Ecija, an important rice producing province in Central Luzon was selected as the nucleus of the study. The provinces of Cagayan in the Ilocos and of Iloilo in the Visayas were included for purposes of comparison.

Survey towns were chosen on the basis primarily of palay production and hectarage. Geographic position was also considered to allow for better coverage.

Lists of palay producers in the barrios were secured with the help of the municipal agriculturist and barrio lieutenants. Systematic sampling was followed such that from each town about one hundred farmers with palay sales were selected for interview. For example, assuming that there were five hundred farmers in the town, every fifth farmer was picked out.

Interviews were conducted from May to June, 1956. The field survey was conducted by the following undergraduate students majoring at the Department of Agricultural Economics: E. Agbisit, D. Crucillo, S. Daof, G. Eala, R. Navarro, C. Sarmago and V. Quintana. Information was collected on the palay crop for 1955-1956.

THE SURVEY AREAS

Based on the 1948 Census of the Philippines, the survey towns in Nueva Ecija averaged 20,104 hectares of which 8,888 or 44 per cent was considered as farm land. Population averaged 28,303. With the exception of Lambunao in Iloilo, the towns in Cagayan and Iloilo show a smaller population in relation to area.

Palay was the most important crop in all towns. Of lesser significance were various other crops. In Nueva Ecija, these consisted of corn, onions, tobacco, and vegetables. In Cagayan, minor crops were represented by corn, tobacco, and sugar cane. In Iloilo, a number of fruits and vegetables composed the secondary crops.

THE FARMERS

Tenurial composition, palay production, and rice consumption varied from one region to another.

Tenure

A high proportion of palay farms in Nueva Ecija is under tenancy. Tenants of various kinds represented almost four-fifths of all operators (table 1).

TABLE 1.—*Tenurial distribution of farmers in Nueva Ecija, Cagayan and Iloilo, Philippines, 1955-1956*

TENURE	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
Number of farmers	985	200	192
	per cent of farmers		
Tenants	78	26	34
Owner-operators	13	65	56
Part-owners	9	9	10
	100	100	100

In contrast, owner-operators tended to be more in Cagayan and Iloilo.

Estimates based on the 1948 Census of Agriculture indicate a similar pattern of distribution for the three provinces (table 2). These data refer to a broader area than does the survey sample, particularly with respect to Cagayan and Iloilo.

TABLE 2.—*Percentage frequency of tenure groups in the Philippines and selected provinces*

TENURE	PROVINCE			PHILIPPINES
	Nueva Ecija	Cagayan	Iloilo	
	per cent of farmers			
Tenants	77	25	59	37
Owner-operators	16	53	32	53
Part-owners	7	22	9	10
Total	100	100	100	100

Source: 1948 Census of Agriculture.

However, the pattern for the country as a whole shows a different distribution. Owner-operators constitute more than half of all operators pointing to their higher proportion in most other provinces.

Production of palay

Under tenancy the marketable amount is much reduced since the farmer retains only a part of the total harvest. In Nueva Ecija, where tenancy is prevalent, the operator's share amounted to 57 per cent of the harvest after deducting the landlord's share and allowances for seed stock, irrigation, harvesting and threshing costs (table 3).

TABLE 3.—*Production and shares of the landlord and the tenant, May, 1955 to April, 1956*

PROVINCE	AVERAGE PRODUCTION	NET TO LANDLORD		NET TO OPERATOR	
	cav./farm	*cav.*	*per cent*	*cav.*	*per cent*
Nueva Ecija	147	54	37	84	57
Cagayan	88	9	11	65	74
Iloilo	143	22	15	105	74

Farmers in Iloilo netted the largest share of 105 cavans or the equivalent of 74 per cent. In Cagayan, the operator received a net of 65 cavans.

A break-down of the farmer's share of production indicated a marketable surplus of 31 to 39 per cent which was roughly 20 to 23 per cent of total production (table 4).

TABLE 4.—*Percentage distribution of operator's net share*

DISPOSAL	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent of cavans		
Sold	36	31	39
Milled, home use	19	64	43
Payment for debts	18	—	—
Stored at home	15	—	5
Others	12	4	14
Total	100	99	101

In Cagayan and Iloilo, milling for home consumption which accounted for 64 and 43 per cent respectively, took the lead as a form of disposal. In Nueva Ecija it accounted for only 19 per cent. Other sizable amounts represented payments for indebtedness and carry-over.

Rice consumption

The annual per capita rice consumption of farm families averaged 3.4 cavans in Nueva Ecija and 3.8 cavans in Cagayan (table 5). More than half of the farm families had a per capita rice consumption of 3.0 to 4.9 cavans. Kearl (1955)[5] estimated the rate for the country to be 3.22 in 1952 and 3.40 in 1953.

TABLE 5.—*Percentage distribution of average per capita consumption of rice*

PER CAPITA CONSUMPTION	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
cavans	*per cent of farmers*		
0.1–2.9	35	32	19
3.0–4.9	58	52	58
5.0–6.9	7	15	19
7.0–9.9	[a]	1	4
Total	100	100	100
Average per capita in cavans	3.4	3.8	4.0

[a] Less than 0.5 per cent.

MARKETING PRACTICES

As the market economy becomes more engrained in Philippine agriculture, the palay farmer will have to farm increasingly for the market. His role in marketing must be learned so that farm practices could be adapted to what the market demands. The requirements of quality, varietal preference, adequate storing for proper timing of sales, fast and efficient transportation should command attention.

Pre-sale practices

After harvest the produce should be prepared on the basis of market considerations. Market desirability is often predicated on quality evaluation which contributes to price determination. In this study only drying, threshing, and cleaning were largely practised before sale.

Drying. Newly harvested palay contains considerable moisture which needs reduction to facilitate threshing and insure safer storage.

[5] D. C. Kearl, *The Philippine Agriculturist*, **38**, 545 (1955).

Farmers in Nueva Ecija and Cagayan dried their palay once. This was done before threshing. In Iloilo, however, many instances of drying after threshing were reported.

Threshing. Generally palay is sold in the form of unhulled grains (rough rice) which can be more conveniently stored and transported. Thus, threshing would invariably come next after drying.

In Nueva Ecija, threshing was done largely with machines (table 6). Most individual farmers who could not afford these threshing machines availed themselves of local threshing operators.

TABLE 6.—*Methods of threshing palay*

METHOD	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent of sales		
Machine	98	8	1
Human feet	2	2	99
Pestle	*	63	—
Work animals	*	25	—
Flailing	—	2	*
Total	100	100	100

* Less than 0.5 per cent.

Threshing in Cagayan consisted generally of pounding with a wooden pestle. Another common practice observed in the province was the use of beasts of burden. A team of work animals were driven around a spread of palay stalks until the grains were stamped out.

Most of the threshing in Iloilo was characterized by human foot-work. Palay sheaves were brought up on an improvised stage of bamboo floors and threshed there. A pole was usually propped as a lateral vault to which threshers held on while trampling the pile of palay.

Cleaning. The presence of foreign matter necessitates some cleaning before the palay is properly fit for the market. Empty hulls must also be separated from the full grains. Much of this sorting is done on the field.

The use of machines insures simultaneous and clean threshing. In Nueva Ecija, where most farmers used machine threshers, cleaning was unnecessary.

Hand winnows, made of woven bamboo, were commonly used in Cagayan. Although strenuous and time consuming, winnowing effectively fans out empty grains and pieces of leaves and straw.

The practice among Iloilo farmers was to pour palay grains from an elevated stage. The breeze blows the empty grains and chaff farther off while the full grains fall directly below. In both this method and hand winnowing, heavy foreign particles may not be completely removed.

Source of price information. Prevailing market prices of their produce should be known to farmers before going to market. Farmers in the survey areas depended entirely on the price quotations of buyers (table 7). Landlords and neighbors were occasional sources only.

TABLE 7.—*Sources of price information*

SOURCE	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
Buyer	76	77	83
Landlord	9	—	7
Neighbor	2	15	2
Rice mill owners	2	8	—
Others [a]	11	—	8

[a] FaCoMa, NARIC, drivers.

Storing

The problem of storage confronts a farmer who wants to withhold part or all of his produce for sale at a later date. Well-informed farmers realize that later prices may be higher than present ones. However, the inadequacy of storage facilities on farms may discourage them from storing.

Place of storage. A survey of available facilities for storing shows that in Nueva Ecija and Iloilo majority of palay sales were first brought home for storing (table 8). Storing in the house would mean that palay was either taken inside the house or kept underneath.

What is striking is the large incidence of sales without previous storing in Nueva Ecija. The immediate disposal of palay is occasioned by the pressure of emergency needs of farm family, outstanding financial obligations, and contract sales.

TABLE 8.—*Places of storage for palay*

PLACE OF STORAGE	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent of sales		
At the house	44	21	62
Granary or "bodega"	14	76	38
No storing	33	2	—
Others [a]	9	1	—
Total	100	100	100

[a] Barn, shed.

Cagayan farmers seemed better off with respect to owning storage houses. These buildings are usually built near the home. These were also available to some extent in Iloilo.

Storage containers. One other consideration in storing is the availability and kind of containers. Burlap bags or gunny sacks found extensive use in Nueva Ecija and Cagayan. Bamboo baskets were more popular in Iloilo than in Nueva Ecija.

Less frequently used containers were clay jars, wooden boxes or barrels, and bins. Many instances of storing in bulk were reported in Iloilo. Here the loose grains are poured inside the granary or dumped into a corner of the house.

Transportation

The movement of farm produce to the market constitutes a problem in distribution. In the absence of pre-arranged pick-up services, hired transportation may be available to either buyer or seller.

Means of transporting palay. Trucks and animal-drawn vehicles were used to a comparable extent in Nueva Ecija and Cagayan (table 9). In Iloilo, farmers negotiated the distance to market partly by motor and by animal-drawn conveyances. A few cases of water transportation were observed in Cagayan where many farms are near the Cagayan River.

Payment for transportation. For hired transportation, the farmer ordinarily incurred the out-of-pocket cost especially in Nueva Ecija (table 10). However, many cases involved "non-payment" particularly in Cagayan. This means that either the farmer delivered the produce to the buyer free of charge or that the buyer brought along his truck to the farm for a pick-up service.

TABLE 9.—*Means of transporting palay from the farm to the market*

METHOD	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent of sales		
Motor vehicles only	46	38	25
Animal-drawn vehicles only [a]	41	42	17
Animal and motor	4	8	53
Others [b]	9	12	5
Total	100	100	100

[a] Bull-carts and sleds.
[b] Human, pack animals and boats.

TABLE 10.—*Methods of paying for transportation*

METHOD	PROVINCE		
	Nueva Ecija	Caiayan	Iloilo
	per cent of sales		
Paid by farmer	53	33	28
No charge	31	61	11
Paid by buyer (undeducted)	2	—	55
Paid by buyer (deducted)	7	6	6
Not ascertained	7	—	—
Total	100	100	100

In some cases buyers paid for hired transportation. This payment could be transferred to farmers by deducting the amount from the buying price of palay. However, the majority of buyers in Iloilo regarded it as an additional service and avoided any direct deduction from the price.

Cost of hired transportation. The cost of transporting a cavan of palay varied from ₱0.12 in Guimba and San Jose to ₱0.24 in Cabanatuan, Nueva Ecija (table 11). On the average, the amount spent on animal-drawn transportation was less by ₱0.04 than that for motor transportation. In spite of this apparent differential in cost, movements by animal power were limited to shorter hauls.

Relation of distance to cost of transportation. Findings showed that there was a direct relationship between transportation cost and distance to market. In Iloilo the writer found that within a near distance of 1 to 3 kilometers the cost per cavan amounted to ₱0.18

TABLE 11.—*Cost of transporting palay in Nueva Ecija*[a]

AREA	METHOD OF TRANSPORTATION		DIFFERENCE
	Vehicle		
	Animal	Motor	
	centavos per cavan		
Nueva Ecija:	14	18	4
Cabanatuan	20	24	4
Cuyapo	13	15	2
Guimba	12	12	–
San Jose	12	18	6
Rizal	16	20	4
Gapan	13	17	4
San Antonio	15	18	3

[a] Cagayan and Iloilo are excluded due to insufficient data.

in Oton and ₱0.10 in Lambunao (table 12). With the distance extended to a range of 9 to 61 kilometers, the same cavan would incur a cost of ₱0.30 in Oton and ₱0.39 in Lambunao.

On a per kilometer basis, an inverse relationship was observed: unit cost decreased as distance increased. In Oton, it started from ₱0.10 down to ₱0.02 per kilometer. Indications were not as clear-cut in Lambunao.

TABLE 12.—*Relation of cost of transportation to distance, 192 farmers, Oton and Lambunao, Iloilo*

DISTANCE	OTON		LAMBUNAO	
	Cost per cavan	Cost per km.	Cost per cavan	Cost per km.
kilometer		*pesos*		
1–3	0.18	0.10	0.10	0.06
4–8	0.24	0.04	0.12	0.03
9–61	0.30	0.02	0.39	0.07

Market outlets

Buyers of palay. Local buyers dominated the market in all three provinces (table 13). The volume of transaction with these buyers amounted to more than one-third in Nueva Ecija, one-half in Cagayan, and one-fourth in Iloilo.

In Cagayan there were few buyer groups. Whereas three-fourths of marketings got into the hands of local buyers and rice mills, the remainder was mainly disposed off to the NARIC. In Iloilo, the central market, represented by merchants and rice mills combined, was the most important outlet.

TABLE 13.—*Types of buyers to whom palay was sold*

TYPE OF BUYERS	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent sold		
Local rice mills	12	20	18
Local buyers	38	55	28
Local stores	[a]	1	1
FaCoMa	5	—	10
NARIC	4	22	—
Central merchants	15	—	23
Central rice mills	11	2	9
Landlord	12	—	4
Not ascertained	3	[a]	7
Total	100	100	100

[a] Less than 0.5 per cent.

Reasons for choosing outlet. A farmer is usually confronted with a number of alternative outlets. Given the freedom of choice, he looks for the best concessions, be it price or some other benefits.

In Nueva Ecija, one-fourth of the sales were transacted on the assumption of a better price (table 14). In Cagayan and Iloilo, however, price considerations were subordinated to personal convenience. Here, about a third of the farmers expedited their sales with the nearest buyer.

TABLE 14.—*Reasons for choosing market outlet*

REASON	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent of sales		
Higher price	26	21	8
Regular buyer	23	25	1
Credit	17	4	19
Nearness, convenience	10	32	31
Buyers sought out palay	5	10	4
Friends, relatives	3	7	10
Only buyer	2	1	26
Others [a]	14	—	1
Total	100	100	100

[a] Honesty, cash, member of FaCoMa.

Eventually, some farmers become accustomed to their regular customers. This attachment to the usual buyer appeared to be the

second significant factor in Nueva Ecija and Cagayan. Also, a good number of farmers had to sell in order to settle their debts.

Variety

In the absence of standard grades, only varietal distinction characterized the farm market for palay. About fifty-two varietal names were noted in this study. Thirty-six individual varieties were reported in Nueva Ecija; six in Cagayan; and ten in Iloilo. Duplication might have been possible owing to the confusion of different names in diferent places for the same variety. However, this double-counting error may be offset by instances wherein a number of different varieties were identified in certain places by one common name.

Varieties of palay sold. Varieties may be categorized by NARIC standards into three main classes or groups: Fancy, Special, and Ordinary. Of the total number of sales in the three provinces, Ordinary varieties were most common, followed by Special varieties. Fancy varieties ranked least.

Fancy variety. Only three varieties were reported of which Wagwag accounted for about 98 per cent in Nueva Ecija and Cagayan. No report of Fancy sales was gathered in Iloilo.

Special variety. Raminad, a Special variety, accounted for 71 per cent of the sales in Nueva Ecija. Elon-elon and Raminad were about equally important in Cagayan. Seraup Kechil made up almost fifty per cent of the sales in Iloilo. Other leading special varieties were Khao Bai Shri, Los Baños, Burma, Apostol, Benser, etc.

Ordinary variety. Considered of lesser quality but constituting the bulk of palay production are numerous varieties classified as Ordinary. Representative examples are the Macan group common in Nueva Ecija and Iloilo and the so-called Ilocano variety in Cagayan.

Volume of sales

More than one-half of the farmers marketed palay only once during the year. More farmers in Nueva Ecija reported subsequent sales.

Sales were generally spread from January to April (table 15). The heavy marketings in January accounted for more than one-third of the harvest. Sales declined in each succeeding month.

The marketing season in Cagayan was characterized by a more gradual increase in volume from January. Marketing was heavily

TABLE 15.—*Monthly volume of sales*

MONTH	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	per cent sold		
May, 1955	4	8	13
June	1	1	11
July to December	5	10	25
January, 1956	36	6	2
February	24	7	19
March	16	24	13
April	14	44	17
Total	100	100	100

concentrated from March to April. The occurrence of many town "fiestas" during these months press farmers to market their palay in order to meet celebration expenses. This accounts for the sudden drop of sales in May. The remaining stock becomes thinly distributed over the year.

Farmers in Iloilo marketed their palay over a longer period. Sales were evenly distributed from February to June. This was made possible by growing a second crop.

Other conditions of sale

Weight of a cavan of palay sold. No standard unit of measure for palay was observed. The weight of a cavan of palay varied from 44 to 50 kilograms (table 16). Transactions in Nueva Ecija were generally based on a 46-kg. cavan. In early sales, buyers usually insisted on a weight exceeding 44-kg. per cavan to offset shrinkage.

TABLE 16.—*Average weight per cavan of palay sold*

WEIGHT IN KILOGRAMS	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
44	3	54	50
46	88	45	3
Others [a]	9	1	47
Total	100	100	100

[a] 45, 47, 48, 50.

Two standard weights seemed to obtain in Cagayan. In one town, a 46-kg. weight was necessary to allow for the higher moisture content. In Iloilo, the 44-kg. was in force.

Method of payment. Payment in cash upon delivery was generally practised in all provinces. Payment in advance of actual delivery was noted in Nueva Ecija and Iloilo. This arrangement suggests pre-harvest sales on the farmer's assurance of future delivery. Direct exchange of palay for other goods was observed in every province, especially in Iloilo.

PRICES AND RECEIPTS

To some extent prices should guide farmers when to market, where to market, what to market, and to whom to market. However, to answer all these questions requires much more data than what is available in this study. The analysis is confined to price differentiation among varieties and to some rough measure of seasonal movements.

Varietal prices. Fancy varieties tended to sell higher than Special or Ordinary varieties. This price variation is markedly noticeable in Nueva Ecija where Fancy netted the highest premium of about a peso over Special (table 17).

TABLE 17.—*Net farm prices of palay sales by varietal class*

VARIETAL CLASS	PROVINCE		
	Nueva Ecija	Cagayan	Iloilo
	pesos per cavan		
Fancy	9.71	7.90	—
Special	8.70	7.75	8.35
Ordinary	8.23	7.40	8.33
Average	8.71	7.55	8.34

In Cagayan, Special was ₱0.35 higher than Ordinary. In Iloilo, however, the price difference was negligible.

Price movements in Nueva Ecija. Prices during the marketing season tended to start from a low level right after the harvest months and to rise gradually towards the off-season months. Prices in December and January were much lower than the peak prices of April. The average price rose to ₱9.53 in April, an increase of ₱1.73 from December (table 18).

Fancy variety registered the highest up-turn of ₱2.01 from December to April. For the same months Special variety was up by ₱0.78 and Ordinary, by ₱1.41. Generally, each varietal class followed the same pattern of price movement (fig. 1).

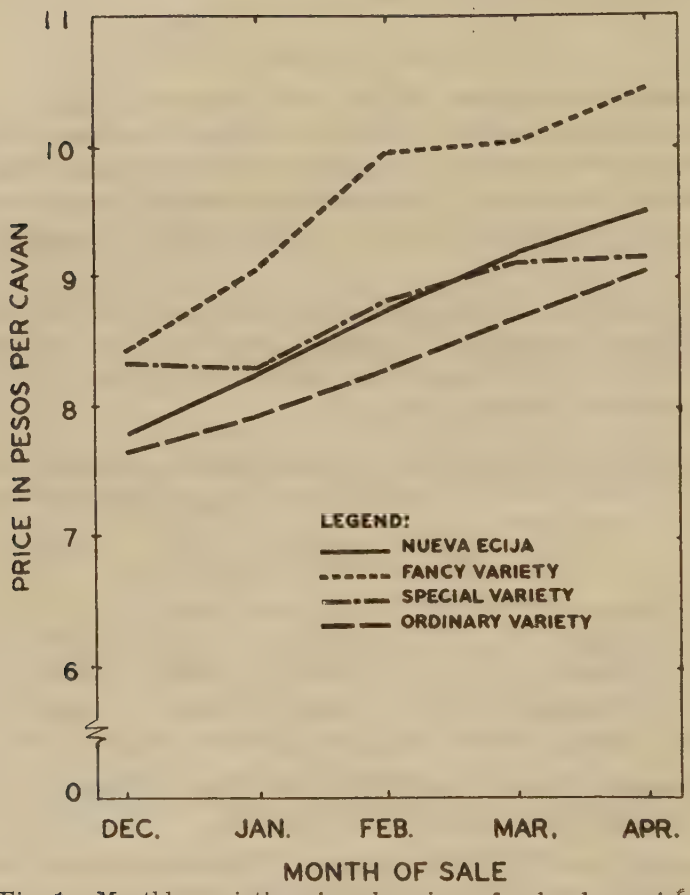

Fig. 1.—Monthly variations in sale prices of palay by varietal class, Nueva Ecija

TABLE 18.—*Monthly net farm prices of palay sales by varietal class, Nueva Ecija* [a]

VARIETAL CLASS	MONTHS				
	Dec.	Jan.	Feb.	Mar.	Apr.
	pesos per cavan				
Nueva Ecija	7.80	8.27	8.78	9.22	9.53
Fancy	8.45	9.08	9.96	10.05	10.46
Special	8.38	8.27	8.81	9.14	9.16
Ordinary	7.66	7.95	8.30	8.72	9.07

[a] December, 1955; January to April, 1956.

The upward behavior of prices is a reflection of the seasonal trend of supply in the opposite direction. On the whole, prices steadily rose as the volume of marketings declined (table 19). A general picture of this relationship is presented in figure 2.

TABLE 19.—*Comparative movements of monthly prices and volume of sales, Nueva Ecija*

INDEX OF VARIATION	MONTH					AVERAGE	TOTAL
	Dec.	Jan.	Feb.	Mar.	Apr.		
	per cent of average						
Index of price variation	90	97	101	105	107	500	100
Index of variation in sales	17	173	147	93	70	500	100

Potential gains from palay storage. It is often argued that farmers should store their harvest to avail themselves of higher prices later in the season. This argument takes on the assumption that storage costs and other waiting costs will be offset by price increases. In Nueva Ecija it would seem most advantageous to store only until April (table 20). The price advance of ₱1.40 from December to April was more than the imputed costs of storage by ₱0.69. An individual farmer would have profited by this much for every cavan of palay. Findings in Cagayan show that price advances during the season fall short of costs. For Iloilo it would pay to store until June in Oton and until July in Lambunao.

Receipts from palay sales. The cash earnings of palay farmers is one measure of their financial success. Using average prices and amount of marketings we may roughly get some expectation of re-

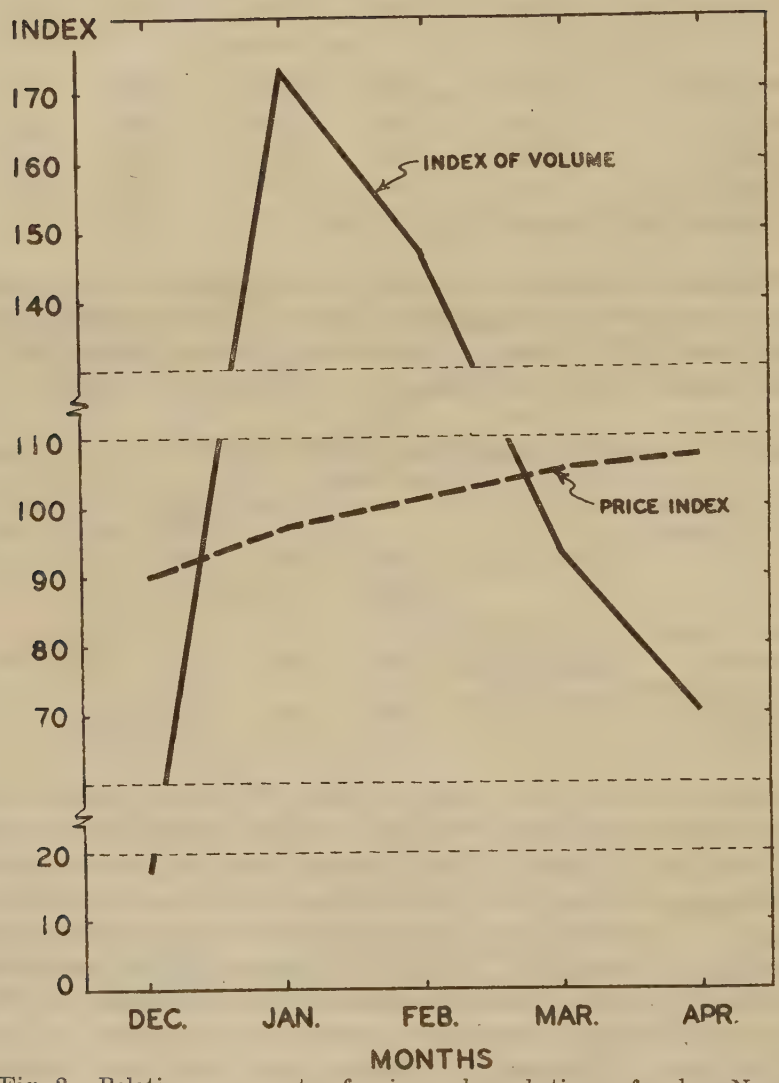

Fig. 2.—Relative movements of price and marketings of palay, Nueva Ecija.

TABLE 20.—*Potential gains or losses from storing ordinary palay in Nueva Ecija* [a]

MONTH	FARM PRICE	ESTIMATED GAINS OR LOSSES IN STORING FROM Nov. to	Dec. to	Jan. to	Feb. to	Mar. to	Apr. to
	pesos per cavan						
November	7.82						
December	7.66	–0.02					
January	7.95	–0.23	0.11				
February	8.30	–0.06	0.28	0.17			
March	8.72	0.18	0.52	0.41	0.24		
April	9.07	0.35	0.69	0.58	0.41	0.16	
May	9.22	0.32	0.66	0.55	0.38	–0.12	–0.04

[a] Assumed costs of storage: 10 centavos per month per cavan stored. One per cent interest per month on value of palay stored.

turns. Farmers in Nueva Ecija would receive ₱137 per sale, or a total receipt of ₱257 (table 21). We expect Cagayan farmers to net low returns because of smaller sales and prices. In spite of lower prices, Iloilo would rank highest in total receipts because of the larger volume of sales.

TABLE 21.—*Average price, volume and expected receipts from palay sales*

PROVINCE	PRICE PER CAVAN	VOLUME PER SALE	EXPECTED RECEIPTS PER SALE	TOTAL QUANTITY SOLD	TOTAL EXPECTED RECEIPTS
	pesos	*cavan*	*pesos*	*cavan*	*pesos*
Nueva Ecija	8.58	16	137	30	257
Cagayan	7.55	14	106	20	151
Iloilo	8.34	29	242	43	359

ESSENTIAL AMINO ACID CONTENT OF SOME TROPICAL TERMITES

ELVIRA B. MANZANILLA and LAURO A. YNALVEZ

This study to determine the possibility of using "termite meal" as a protein supplement in poultry and livestock was undertaken in the Department of Agricultural Chemistry from June, 1957 to September, 1957.

Three kinds of termites named according to their habitat as wood termite A (*Coptotermes vastator* Light), wood termite B (*Nasutitermes luzonicus* [Oshima]), and aerial termite (*Nasutitermes luzonicus* [Oshima]), were oven-dried and ground in a Wiley Mill. Amino acid assays of the meals were then made according to the procedures of Block and Bolling (1948).[1] Table 1 shows the results of these assays.

Each value in the table is an average of four trials for each test material. Except for phenylalanine, the three kinds of termite appear to have the same arginine, lysine and histidine content both on a dry weight and protein basis. Wood termite A seems to have higher phenylalanine content based on its protein content. A possible explanation for this is that any difference in the environment will be reflected in the food and therefore in the nutrition of the termites. Wood termite A had about the same phenylalanine content as that of whole egg protein (Hirsch *et al.*, 1952).[2]

TABLE 1.—*The amino acid content of three kinds of termites*

CONSTITUENT	WOOD TERMITE A	WOOD TERMITE B	AERIAL TERMITE	WHOLE EGG PROTEIN
Protein, per cent N × 6.25	40.40	62.47	60.03	—
Per cent amino acids:				
Arginine	0.38	0.45	0.52	5.7
Histidine [a]	—	—	—	2.4
Lysine	0.19	0.32	0.36	7.3
Phenylalanine	1.81	1.93	1.38	5.4
Grams amino acids per 16 grams nitrogen:				
Arginine	0.89	0.72	0.87	
Lysine	0.44	0.52	0.60	
Phenylalanine	4.33	2.93	2.31	

[a] Negative results were obtained with 2.5 gm. samples.

[1] R. J. Block and D. Bolling, "The determination of the amino acids," Minnesota, Burgess Publishing Co., 1948, pp. 1-15.

[2] J. S. Hirsch *et al.*, Food Research **17**, 462-7 (1952).

HEART BEAT, RESPIRATION AND BODY TEMPERATURE OF BERKSHIRE SWINE

MOISES R. DE GUZMAN

The study was undertaken to obtain data on the three physiological characters which are widely considered as good indices of the adaptability of an animal to its environment. This was considered timely because the Berkshire breed, although long known in this country, was introduced in great numbers for commercial raising only after the last war.

Twelve gilts and two boars were given identical feed, care and management. They were allowed free access to water and were given soilage of camote vines.

The results presented in table 1 agree with the findings of other workers. One incidental observation is that the characters were noticeably affected by season. During the dry season the gilts had a mean of 69.6 heart beats per minute; mean respiratory rate, 23.73 per minute; and mean body temperature, 38.49°C. During the wet season the corresponding figures were 79.87, 31.32 and 38.59. In gilts, heart beat was significantly correlated with relative humidity ($r = 0.6785$); respiratory rate, significantly correlated with rainfall ($r = 0.4789$).

TABLE 1.—*Heart beat, respiration and body temperature of Berkshire swine*

BREED	HEART BEAT PER MINUTE	RESPIRATORY RATE PER MINUTE	BODY TEMPERATURE DEGREE C	AUTHOR
Not specified	60–80	8–18	37.5–38.5	Udall (1922)
Not specified	70–80	10–15	39.2	Hadley (1939)
Not specified	60–100	10–15	38.0–40.0	Malkmars (1944)
Not specified	—	—	38.7–39.8	Palmer (cited by Dukes, 1947)
			39.2	
Not specified	60–145	11–47	37.8–41.3	Rubio (1951)
Berkjala	—	—	39.24	Villegas (1952)
Berkjala	64–146	15–54	37.46–40.79	Palao (1952)
	108.29±1.11	33.89±0.42	39.19	
Berkshire				Present study
Gilt	48–120	8–90	37.8–40.7	
	75.59	28.16	38.55	
Boars	48–90	24–92	37.9–38.9	
	68.67	47.23	38.34	

LECHON STUDIES

VALENTE VILLEGAS

From six Berkjala pigs roasted (lechon) the following data were obtained:

ITEM	MEASUREMENTS	
	Range	Average
Live weight	29.0–32.0	30.7 kg.
Height	43.5–47.2	45.2 cm.
Heart girth	74.0–75.3	75.3 cm.
Body length	53.0–57.0	55.2 cm.
Weight of blood shed	1.1– 1.5	1.3 kg.
Liver		866.7 g.
Kidney		120.8 g.
Spleen		77.5 g.
Heart		128.7 g.
Dressed weight	21.1–24.0	22.9 kg.
Dressing percentage	67.2–78.7	74.3
Dressing operation		3.5 hrs.
Overnight shrinkage		1.2 kg.
Weight before roasting	20.2–23.2	21.7 kg.
Weight of lechon	14.7–20.6	18.8 kg.
Head 310 g. or 1.54 per cent		
Hindleg 280 g. or 1.49 per cent		
Ears 130 g.		
Tail 30 g.		
Grain 80 g.		
Lean 11.48 kg. 61.06		
Skin 2,210 g.		
Bones 2.88 kg. 15.32		

Consumption:

	Group I	*Group II*
Weight of partaker	55.8	44.2 kg.
Lechon	175.09	80.1 g.
Dinuguan	212.09	71.0 g.
Soup	325.09	456.0 g.
Boiled chicken, etc.	50.09	78.8 g.
Rice	237.5	251.2
Fish	—	60.8 g.
Salad	—	71.0 g.
Patis, etc.	—	5.6 g.

Proximate analysis of lechon: moisture, 6.74 per cent; protein, 33.16; fat, 37.83; ash, 2.12.